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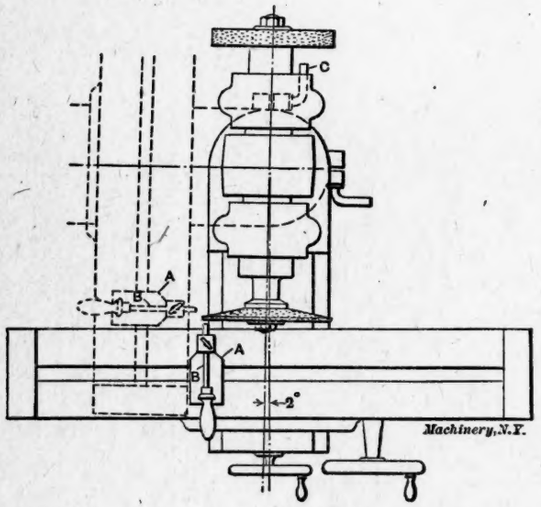
Supplement to MACHINERY, July, 1908.

Operations for the Article in this number entitled "Machine Shop Practice—Grinding a Gear-cutter."

SHOP OPERATION SHEET NO. 67.

Ethan Viall. MACHINERY, July, 1908.

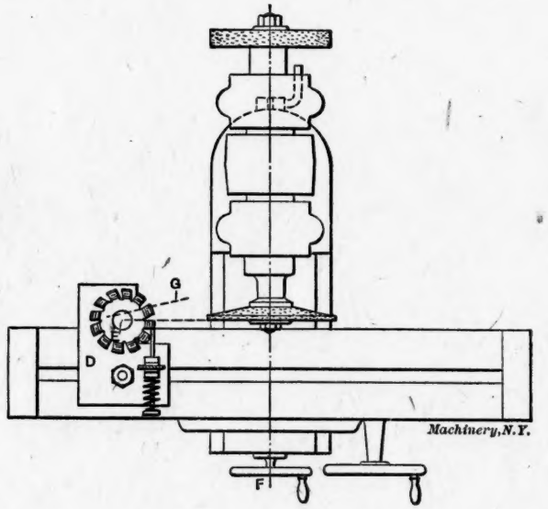


Grinding a Gear-cutter—Truing the Emery Wheel.

1. Be sure that there is no play in the grinder spindle, that it runs freely and is well oiled; also see that the table ways are clean and free from grit and have oil enough so that the table can be moved easily.
2. Select a free-cutting saucer-shaped emery wheel about 6 inches in diameter, of medium grade and grain, and one that will not glaze or wear too fast.
3. Place the wheel, with the concave side out, on the end of the spindle which has a right-hand thread on it, which is the end that turns to the left when facing it.
4. Bolt the diamond holder *A* near the right-hand end of the table and clamp the diamond truing tool *B* in place.
5. Swing the knee around until the table is parallel with the spindle, and in the position indicated by the dotted lines. Adjust the table vertically until the diamond point is slightly below the center of the spindle, and then tighten the clamp *C*.
6. Start the grinder, and true up the wheel by feeding the diamond across its periphery.
7. Move the diamond truing tool and holder to the left end of the table. Loosen the clamp *C*, and swing the knee around until its center line makes an angle of 2 degrees with the axis of the spindle, as shown in the illustration, and again clamp the knee.
8. Bring the diamond truing tool into contact with the face of the wheel, and beginning at the edge, true at least a half-inch of its surface, and more if needed. Cut deep enough to remove all old glaze, and to true the wheel perfectly.

SHOP OPERATION SHEET NO. 68.

Ethan Viall. MACHINERY, July, 1908.



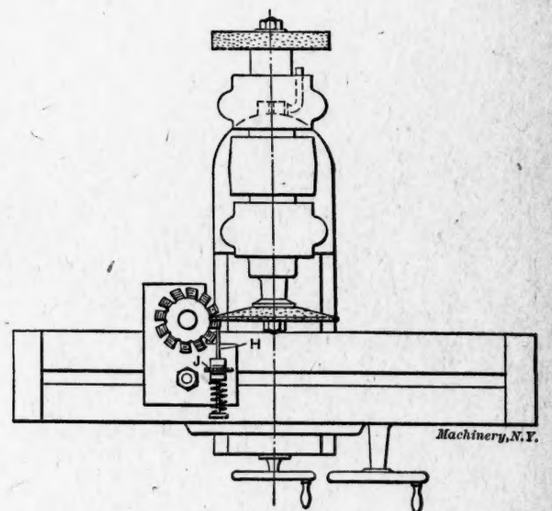
Grinding a Gear-cutter—Lining up Center of Cutter with Face of Wheel.

1. After truing the wheel as described in the previous operation sheet, carefully wipe off the table and clean out the slot.
2. Bolt a gear-cutter fixture *D* to the left end of the table, and place the cutter to be ground on the pin *E*, so that the teeth on that side of the cutter which is next to the wheel, will have their faces toward it. Loosen the table clamp and adjust the table vertically until the centers of the cutter teeth are the same height as the center of the grinder spindle.
3. Carefully line up the table so that it is parallel with the face of the wheel. If there are no graduations on the machine for this purpose, set the table with the trued surface of the wheel, using a straight-edge.
4. With the jig and cutter far enough to the left to be clear of the wheel, lay a straight-edge across the face of the wheel and move the table out or in by means of the wheel *F* until the center of the pin *E* holding the gear-cutter is exactly in line with the outside face of the wheel. When the cutter is set in this way, the faces of the teeth will be radial or in line with the axis of the cutter.

NOTE.—It is important that the teeth of a gear-cutter be ground radially in order that the form of the teeth shall not be changed. If the top of a tooth is ground back faster than the base, and the face of the tooth be in the plane indicated by the line *G*, the shape of the tooth space cut is distorted, and a gear with badly shaped teeth is the result. In addition to this, the cutter works badly owing to the negative rake.

SHOP OPERATION SHEET NO. 69.

Ethan Viall. MACHINERY, July, 1908.



Grinding a Gear-cutter—Setting the Stop and Grinding.

NOTE.—It is assumed that the axis of the cutter is in line with the face of the emery wheel, and that the wheel has been trued.

1. Adjust the table longitudinally until the edge of the wheel rests against the bottom of one of the flutes between the teeth of the gear-cutter, and then tighten the table stop in the proper position to prevent the wheel from grinding the flute to a greater depth.
2. Turn the gear-cutter until a tooth rests lightly against the face of the wheel, then adjust the spring-stop *H* against the back of the tooth so that the cutter can be indexed freely, and also so that it will be held firmly against the wheel.
3. Move the cutter to the left until it is clear of the wheel and start the machine.
4. Carefully grind each tooth in turn, taking light cuts, then feed the teeth forward slightly by turning the knurled nut *J* which feeds the spring-stop *H*. Continue grinding until all cutting-edges are sharp and even.

NOTE.—When grinding cutters, light cuts must be taken to prevent the temper from being drawn from the cutting-edges, which would, of course, spoil the cutter. The face of the wheel which comes in contact with the work should be narrow, especially for dry cutter grinding, in order that the heat generated may be reduced to a minimum. If the cutter gets warm while grinding, remove it and cool in water. A moderately heavy and well-balanced wheel placed on the opposite end of the spindle will cause the grinder to run more steadily.

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Tables for the Article in this number entitled "M

IX.—TABLE OF IDEAL MOMENTS.

All values may be read in hundreds or thousands of inch pounds.

Bending Moments in Inch Pounds = M_b.		Torsional Moments in Inch Pounds = M_t.																	Bending Moment
		50	100	150	200	250	300	400	500	600	700	800	900	1000	1200	1400	1600	1800	
50	T	70.71	111.8	158.1	206.2	255.0	304.1	403.1	502.5	602.1	2119	2154	2193	2236	2332	2441	2561	2691	2000
	B	120.7	161.8	208.1	256.2	305.0	354.1	453.1	552.5	652.1	4119	4154	4193	4236	4332	4441	4561	4691	
75	T	90.14	125.0	167.7	213.6	261.0	309.2	407.0	505.6	604.7	704.0	803.5	2377	2417	2506	2608	2720	2843	2200
	B	165.1	200.0	242.7	288.6	336.0	384.2	482.0	580.6	679.7	779.0	878.5	4577	4617	4706	4808	4920	5043	
100	T	111.8	141.4	180.3	223.6	269.3	316.2	412.3	509.9	608.3	707.1	806.2	2583	2600	2683	2778	2884	3000	2400
	B	211.8	241.4	280.3	323.6	369.3	416.2	512.3	609.9	708.3	807.1	906.2	4963	5000	5083	5178	5284	5400	
125	T	134.6	160.1	195.3	235.9	279.5	325.0	419.1	515.4	612.9	711.1	809.7	908.6	2786	2864	2953	3053	3162	2600
	B	259.6	285.1	320.3	360.9	404.6	450.0	544.1	640.4	737.9	836.1	934.7	1034	5536	5464	5553	5653	5762	
150	T	158.1	180.3	212.1	250.0	291.5	335.4	427.2	522.0	618.5	715.9	813.9	912.4	2973	3046	3131	3225	3329	2800
	B	308.1	330.3	362.1	400.0	441.5	485.4	577.2	672.0	768.5	865.9	963.9	1062	5773	5846	5931	6025	6129	
200	T	206.2	223.6	250.0	282.8	320.2	360.6	447.2	538.5	632.5	728.0	824.6	922.0	1020	3231	3311	3400	3499	3000
	B	406.2	423.6	450.0	482.8	520.2	560.6	647.2	738.5	832.5	928.0	1025	1122	1220	6231	6311	6400	6499	
250	T	255.0	269.3	291.5	320.2	353.6	390.5	471.7	559.0	650.0	743.3	838.2	934.1	1031	1226	3770	3848	3936	3500
	B	505.0	519.3	541.5	570.2	603.6	640.5	721.7	809.0	900.0	993.3	1088	1184	1281	1476	7270	7348	7436	
300	T	304.2	316.2	335.4	360.6	390.5	424.3	500.0	583.1	670.8	761.6	854.4	948.7	1044	1237	1432	4308	4386	4000
	B	604.2	616.2	635.4	660.6	690.5	724.3	800.0	883.1	970.8	1062	1154	1249	1344	1537	1732	8308	8386	
350	T	353.6	364.0	380.8	403.1	430.1	461.0	531.5	610.3	694.9	782.6	873.2	965.7	1059	1250	1443	1638	4847	4500
	B	703.6	714.0	730.8	753.1	780.1	811.0	881.5	960.3	1045	1133	1223	1316	1409	1600	1793	1988	9347	
400	T	403.1	412.3	427.2	447.2	471.7	500.0	565.7	640.3	721.1	806.2	894.4	984.9	1077	1265	1456	1649	1844	400
	B	803.1	812.3	827.2	847.2	871.7	900.0	965.7	1040	1121	1206	1294	1385	1477	1665	1856	2049	2244	
450	T	452.8	461.0	474.3	492.4	514.8	540.8	602.1	672.7	750.0	832.2	917.9	1006	1097	1282	1471	1662	1855	450
	B	902.8	911.0	924.3	942.4	964.8	990.8	1052	1123	1200	1282	1368	1456	1547	1732	1921	2112	2305	
500	T			522.0	538.5	559.0	583.1	640.3	707.1	781.0	860.2	943.4	1030	1118	1300	1487	1676	1868	500
	B			1022	1039	1059	1083	1140	1207	1281	1360	1443	1530	1618	1800	1987	2176	2368	
600	T			618.5	632.5	650.0	670.8	721.1	781.0	848.5	922.0	1000	1082	1166	1342	1523	1709	1897	600
	B			1219	1233	1250	1271	1321	1381	1449	1522	1600	1682	1766	1942	2123	2309	2497	
700	T				728.0	743.3	761.6	806.2	860.2	922.0	990.0	1063	1140	1221	1389	1565	1746	1931	700
	B				1428	1443	1462	1506	1560	1622	1690	1763	1840	1921	2089	2265	2446	2631	
800	T				824.6	838.2	854.4	894.4	943.3	1000	1063	1131	1204	1281	1442	1612	1799	1970	800
	B				1625	1638	1654	1694	1743	1800	1863	1931	2004	2081	2242	2412	2589	2770	
900	T					934.1	948.7	984.9	1030	1082	1140	1204	1273	1345	1500	1664	1836	2012	900
	B					1834	1849	1885	1930	1982	2040	2104	2173	2245	2400	2564	2736	2912	
1000	T					1031	1044	1077	1118	1166	1221	1281	1345	1414	1562	1720	1887	2059	1000
	B					2031	2044	2077	2118	2166	2221	2281	2345	2414	2562	2720	2887	3059	
1100	T						1140	1170	1208	1253	1304	1360	1421	1487	1628	1780	1942	2110	1100
	B						2240	2270	2308	2353	2404	2460	2521	2587	2728	2880	3042	3210	
1200	T						1237	1265	1300	1342	1389	1442	1500	1562	1697	1844	2000	2163	1200
	B						2437	2465	2500	2542	2589	2642	2700	2762	2897	3044	3200	3363	
1400	T							1456	1487	1523	1565	1612	1664	1720	1844	1980	2126	2280	1400
	B							2856	2887	2923	2965	3012	3064	3120	3244	3380	3526	3680	
1600	T							1649	1676	1709	1746	1789	1836	1887	2000	2126	2263	2608	1600
	B							3249	3276	3309	3346	3389	3436	3487	3600	3726	3863	4208	
1800	T								1868	1897	1931	1970	2012	2059	2163	2280	2408	2546	1800
	B								3668	3697	3731	3770	3812	3859	3963	4080	4208	4346	

M_t = Torsional Moment
M_b = Bending Moment
T = Ideal Torsional Moment
B = Ideal Bending Moment

$T = \sqrt{M_t^2 + M_b^2}$ and $B = M_b + \sqrt{M_t^2 + M_b^2}$

These ideal moments being for use with the Polar Section Modulus.

The values at right of heavy zig-zag line across upper right-hand corner are for the bending moments 2,000 to 4,500, inclusive, in right-hand column.

Contributed by John S. Myers.

X.—TABLE OF IDEAL MOMENTS.

Bending Moments in Inch Pounds = M_b.		Torsional Moments in Inch Pounds = M_t.																	
		2000	2200	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	7000	8000	9000	10000	11000	12000
600	T	2088	2280	2474	2864	3256	3650	4045	4441	4837	5235	5632	6030	7026	8023	9020	10018	11016	12015
	B	2688	2880	3074	3464	3856	4250	4645	5041	5437	5835	6232	6630	7626	8623	9620	10618	11616	12615
700	T	2119	2301	2500	2886	3276	3667	4061	4455	4851	5247	5644	6041	7035	8031	9027	10025	11022	12020
	B	2819	3001	3200	3586	3976	4367	4761	5155	5551	5947	6344	6741	7735	8731	9727	10725	11722	12720
800	T	2154	2341	2530	2912	3298	3688	4076	4472	4866	5261	5657	6053	7046	8040	9035	10032	11029	12027
	B	2954	3141	3330	3712	4098	4488	4876	5272	5666	6061	6457	6853	7846	8840	9835	10832	11829	12827
900	T	2193	2377	2563	2941	3324	3711	4100	4491	4884	5277	5672	6067	7058	8051	9045	10040	11037	12034
	B	3093	3277	3463	3841	4224	4611	5000	5391	5784	6177	6572	6967	7958	8951	9945	10940	11937	12934
1000	T	2236	2419	2600	2973	3353	3736	4123	4512	4903	5295	5689	6083	7071	8062	9055	10050	11045	12042
	B	3236	3419	3600	3973	4353	4736	5123	5512	5903	6295	6689	7083	8071	9062	10055	11050	12045	13042
1100	T	2283	2460	2640	3008	3384	3764	4149	4535	4924	5315	5707	6100	7086	8075	9067	10060	11055	12050
	B	3383	3560	3740	4108	4484	4864	5249	5635	6024	6415	6807	7100	8186	9175	10167	11160	12155	13150
1200	T	2332	2506	2683	3046	3418	3795	4176	4561	4948	5337	5764	6119	7102	8090	9080	10072	11065	12060
	B	3532	3706	3883	4246	4618	4995	5376	5761	6148	6537	6964	7319	8302	9290	10280	11272	12265	13260
1400	T	2441	2608	2778	3131	3493	3863	4238	4617	5000	5385	5772	6161	7139	8122	9108	10097	11089	12081
	B	3841	4008	4178	4531	4893	5263	5638	6017	6400	6785	7172	7561	8539	9522	10580	11497	12489	13481
1600	T	2561	2720	2884	3225	3578	3940	4308	4682	5060	5441	5824	6210	7181	8158	9141	10127	11116	12106
	B	4161	4320	4484	4825	5178	5540	5908	6282	6660	7041	7424	7810	8781	9758	10741	11727	12716	13706
1800	T	2691	2843	3000	3329	3672	4025	4386	4754	5126	5503	5882	6264	7228	8200	9178	10161	11146	12134
	B	4491	4643	4800	5129	5472	5825	6186	6554	6926	7303	7682	8064	9028	10000	10978	11961	12946	13934
2000	T	2828	2973	3124	3441	3774	4119	4472	4837	5200	5571	5946	6325	7141	8246	9220	10198	11180	12166
	B	4828	4973	5124	5441	5774	6119	6472	6837	7200	7571	7946	8325	9141	10246	11220	12198	13180	14166
2200	T	2973	3111	3256	3561	3883	4219	4565	4919	5280	5646	6019	6391	7338	8297	9265	10239	11218	12200
	B	5173	5311	5456	5761	6083	6419	6765	7119	7480	7846	8219	8591	9538	10497	11465	12439	13418	14400
2400	T	3124	3256	3394	3688	4000	4327	4665	5012	5367	5727	6093	6462	7400	8352	9315	10284	11259	12238
	B	5524	5656	5794	6088	6400	6727	7065	7412	7767	8127	8493	8862	9800	10752	11715	12684	13659	14638
2600	T	3280	3406	3538	3821	4123	4441	4771	5111	5459	5814	6174	6532	7467	8412	9368	10333	11303	12278
	B	5880	6006	6138	6421	6723	7041	7371	7711	8059	8414	8774	9132	10067	11012	11968	12933	13903	14878
2800	T	3441	3561	3688	3960	4252	4561	4883	5216	5557	5906	6261	6621	7533	8476	9426	10385	11351	12322
	B	6241	6361	6488	6760	7052	7361	7683	8016	8357	8706	9061	9421	10333	11276	12226	13185	14151	15122
3000	T	3601	3720	3842	4104	4386	4688	5000	5325	5660	6003	6353	6708	7616	8544	9487	10440	11402	12364
	B	6601	6720	6842	7104	7386	7688	8000	8325	8660	9003	9353	9708	10616	11544	12487	13440	14402	15364
3500	T	4031	4134	4244	4482	4742	5021	5315	5622	5941	6268	6604	6946	7826	8732	9657	10609	11543	12500
	B	7531	7634	7744	7982	8242	8521	8815	9122	9441	9768	10104	10446	11326	12232	13157	14109	15043	16000
4000	T	4472	4565	4665	4883	5123	5381	5657	5946	6248	6561	6882	7211	8062	8944	9849	10770	11705	12649
	B	8472	8565	8665	8883	9123	9381	9657	9946	10248	10561	10882	11211	12062	12944	13849	14770	15705	16649
4500	T	4924	5009	5100	5300	5522	5763	6021	6294	6580	6877	7184	7500	8322	9179	10062	10966	11885	12816
	B	9424	9509	9600	9800	10022	10263	10521	10794	11080	11377	11684	12000	12822	13679	14562	15466	16385	17316
5000	T	5385	5463	5546	5731	5936	6161	6403	6660	6931	7214	7507	7810	8602	9434	10296	11180	12083	13000
	B	10385	10463	10546	10731	10936	11161	11403	11660	11931	12214	12507	12810	13602	14434	15296	16180	17083	18000
5500	T	5852	5924	6001	6172	6363	6573	6801	7043	7300	7569	7849	8139	8902	9708	10548	11413	12298	13200
	B	11352	11424	11501	11672	11863	12073	12301	12543	12800	13069	13349	13639	14402	15208	16048	16913	17798	18700
6000	T	6325	6391	6462	6621	6800	6987	7211	7440	7684	7940	8207	8485	9220	10000	10817	11662	12530	13416
	B	12325	12391	12462	12621	12800	12987	13211	13440	13684	13940	14207	14485	15220	16000	16817	17662	18530	19416

Contributed by John S. Myers.

XI.—DIAMETERS OF SHAFTS FOR COMBINED TORSION AND BENDING STRESSES.

Fiber Stress in Pounds per square inch			Torsional Moments in Thousands of Inch Pounds.																		Fiber Stress in Pounds per square inch		
7500			0	3.75	7.5	11.25	15	18.75	22.5	30	37.5	45	52.5	60	67.5	75	90	105	120	135			7500
	10000		0	5	10	15	20	25	30	40	50	60	70	80	90	100	120	140	160	180		10000	
		12500	0	6.25	12.5	18.75	25	31.25	37.5	50	62.5	75	87.5	100	112.5	125	150	175	200	225	12500		
0	0	0	0	1 1/8	1 23/32	1 31/32	2 3/16	2 11/32	2 1/2	2 3/4	2 15/16	3 1/8	3 9/16	3 7/16	3 19/32	3 23/32	3 15/16	4 5/32	4 11/32	4 1/2	0	0	0
3.75	5	6.25	1 23/32	1 27/32	2 1/32	2 7/32	2 3/8	2 1/2	2 5/8	2 27/32	3 1/16	3 1/32	5 13/16	5 31/32	5 31/32	6	6 1/16	6 1/16	6 1/8	6 3/16	250	200	150
5.625	7.5	9.375	1 31/32	2 1/32	2 3/16	2 5/16	2 15/32	2 19/32	2 11/16	2 29/32	3 1/32	3 1/4	3 13/32	3 9/16	6 1/16	6 3/16	6 1/4	6 1/4	6 5/16	6 3/8	275	220	165
7.5	10	12.5	2 3/16	2 1/32	2 3/16	2 1/16	2 9/16	2 21/32	2 25/32	2 31/32	3 3/32	3 5/16	3 7/16	3 19/32	6 5/16	6 3/8	6 3/8	6 7/16	6 1/16	6 1/2	300	240	180
9.375	12.5	15.63	2 11/32	2 3/8	2 7/16	2 17/32	2 21/32	2 3/4	2 27/32	3 1/32	3 3/16	3 11/16	3 1/2	3 5/8	3 3/4	6 1/2	6 9/16	6 9/16	6 5/8	6 5/8	325	260	195
11.25	15	18.75	2 1/2	2 1/2	2 9/16	2 31/32	2 3/4	2 13/16	2 29/32	3 3/32	3 1/4	3 13/32	3 11/32	3 21/32	3 25/32	6 5/8	6 11/16	6 11/16	6 3/4	6 13/16	350	280	210
15	20	25	2 3/4	2 3/4	2 25/32	2 27/32	2 29/32	3	3 1/16	3 1/32	3 11/32	3 1/2	3 3/8	3 3/4	3 27/32	3 31/32	6 13/16	6 7/8	6 7/8	6 15/16	375	300	225
18.75	25	31.25	2 15/16	2 15/16	2 31/32	3 1/32	3 3/32	3 1/8	3 5/16	3 11/32	3 15/32	3 19/32	3 23/32	3 13/16	3 15/16	4 5/32	4 5/32	7 3/16	7 3/16	7 1/4	437.5	350	262.5
22.5	30	37.5	3 1/8	3 5/32	3 5/32	3 1/16	3 1/4	3 5/32	3 5/32	3 1/16	3 9/16	3 11/16	3 25/32	3 1/8	4	4 5/32	4 9/32	4 15/32	7 1/2	7 1/2	500	400	300
26.25	35	43.75	3 9/32	3 5/32	3 5/16	3 11/32	3 3/8	3 5/32	3 15/32	3 9/16	3 21/32	3 3/4	3 7/8	3 31/32	4 1/16	4 5/32	4 11/32	4 1/2	4 27/32	7 13/16	562.5	450	337.5
30	40	50	3 7/16			3 15/32	3 1/2	3 17/32	3 19/32	3 21/32	3 3/4	3 27/32	3 15/16	4 1/16	4 1/8	4 5/32	4 13/32	4 9/16	4 23/32	4 27/32	50	40	30
33.75	45	56.25	3 19/32				3 5/8	3 21/32	3 11/16	3 25/32	3 27/32	3 15/16	4 5/32	4 1/8	4 7/32	4 9/32	4 7/16	4 5/8	4 3/4	4 29/32	56.25	45	33.75
37.5	50	62.5	3 23/32				3 3/4	3 23/32	3 13/16	3 7/8	3 15/16	4 1/32	4 1/8	4 7/16	4 9/32	4 11/32	4 1/2	4 21/32	4 13/16	4 15/16	62.5	50	37.5
45	60	75	3 15/16				3 31/32	4	4 1/32	4 1/16	4 1/8	4 3/16	4 9/32	4 11/32	4 13/32	4 1/2	4 5/8	4 23/32	4 29/32	5 1/32	75	60	45
52.5	70	87.5	4 5/32				4 3/16	4 7/16	4 7/32	4 1/4	4 5/16	4 3/8	4 13/32	4 15/32	4 17/32	4 5/8	4 3/4	4 7/8	5	5 1/8	87.5	70	52.5
60	80	100	4 11/32					4 3/8	4 13/32	4 15/32	4 1/2	4 17/32	4 19/32	4 21/32	4 3/4	4 27/32	4 31/32	5 3/32	5 7/32	100	80	60
67.5	90	112.5	4 1/2					4 17/32	4 19/32	4 5/8	4 21/32	4 23/32	4 3/4	4 13/16	4 7/8	4 31/32	5 1/16	5 1/16	5 5/16	112.5	90	67.5
75	100	125	4 11/16					4 23/32	4 23/32	4 3/4	4 25/32	4 13/16	4 7/8	4 15/16	4 31/32	5 3/32	5 1/16	5 9/16	5 5/8	125	100	75
82.5	110	137.5	4 13/16					4 27/32	4 7/8	4 29/32	4 15/16	4 31/32	5	5 1/32	5 3/32	5 1/16	5 9/32	5 5/8	5 15/32	137.5	110	82.5
90	120	150	4 31/32						5	5 1/32	5 1/16	5 3/32	5 1/8	5 5/32	5 5/32	5 9/32	5 5/8	5 15/32	5 1/16	150	120	90
105	140	175	5 7/32						5 1/4	5 9/32	5 1/16	5 11/32	5 11/32	5 3/16	5 1/16	5 1/2	5 1/16	5 21/32	5 23/32	175	140	105
120	160	200	5 15/32							5 1/2	5 17/32	5 17/32	5 9/16	5 19/32	5 5/8	5 11/16	5 3/4	5 13/16	6	200	160	120
135	180	225	5 11/16							5 23/32	5 3/4	5 3/4	5 25/32	5 25/32	5 13/16	5 7/8	5 13/16	6	6 1/16	225	180	135

Bending Moments in Thousands of Inch Pounds.

Values at right of heavy zig-zag line across upper right-hand corner are for the bending moments in upper part of three right-hand columns.

Contributed by John S. Myers.

XII.—DIAMETERS OF SHAFTS FOR COMBINED TORSION AND BENDING STRESSES.

Fiber Stress in Pounds per square inch			Torsional Moments in Thousands of Inch Pounds.																			
7500			0	150	165	180	210	240	270	300	330	360	390	420	450	525	600	675	750	825	900	
	10000		0	200	220	240	280	320	360	400	440	480	520	560	600	700	800	900	1000	1100	1200	
		12500	0	250	275	300	350	400	450	500	550	600	650	700	750	875	1000	1125	1250	1375	1500	
0	0	0	0	4 11/16	4 13/16	4 31/32	5 7/32	5 15/32	5 11/16	5 7/8	6 1/16	6 1/4	6 7/16	6 9/16	6 3/4	7 1/16	7 7/16	7 11/16	8	8 1/4	8 1/2	
45	60	75	3 15/16	5 5/32	5 9/32	5 3/8	5 19/32	5 13/16	6	6 3/16	6 3/8	6 1/2	6 11/16	6 13/16	6 15/16	7 5/16	7 5/8	7 7/8	8 1/8	8 3/8	8 5/8	
52.5	70	87.5	4 5/32	5 1/4	5 11/32	5 15/32	5 11/16	5 7/8	6 1/16	6 1/4	6 7/16	6 9/16	6 3/4	6 7/8	7	7 5/16	7 5/8	7 15/16	8 3/16	8 7/16	8 5/8	
60	80	100	4 11/32	5 5/16	5 7/16	5 17/32	5 3/4	5 15/16	6 1/8	6 5/16	6 7/16	6 5/8	6 3/4	6 7/8	7 1/16	7 3/8	7 11/16	7 15/16	8 3/16	8 7/16	8 11/16	
67.5	90	112.5	4 1/2	5 13/32	5 1/2	5 5/8	5 13/16	6	6 3/16	6 5/16	6 1/2	6 5/8	6 13/16	6 15/16	7 1/16	7 3/8	7 11/16	8	8 1/4	8 1/2	8 11/16	
75	100	125	4 11/16	5 15/32	5 19/32	5 11/16	5 7/8	6 1/16	6 1/4	6 3/8	6 9/16	6 11/16	6 13/16	7	7 1/8	7 7/16	7 3/4	8	8 1/4	8 1/2	8 3/4	
82.5	110	137.5	4 13/16	5 9/16	5 21/32	5 3/4	5 15/16	6 1/8	6 5/16	6 7/16	6 5/8	6 3/4	6 7/8	7	7 1/8	7 1/2	7 3/4	8 1/16	8 5/16	8 1/2	8 3/4	
90	120	150	4 31/32	5 21/32	5 3/4	5 27/32	6	6 3/16	6 3/8	6 1/2	6 5/8	6 3/4	6 15/16	7 1/16	7 3/16	7 1/2	7 13/16	8 1/16	8 5/16	8 9/16	8 3/4	
105	140	175	5 7/32	5 13/16	5 7/8	5 31/32	6 1/8	6 5/16	6 7/16	6 5/8	6 3/4	6 7/8	7	7 1/8	7 1/4	7 9/16	7 7/8	8 1/8	8 3/8	8 5/8	8 13/16	
120	160	200	5 15/32	5 31/32	6 1/16	6 1/8	6 5/16	6 7/16	6 9/16	6 11/16	6 13/16	7	7 1/8	7 1/4	7 3/8	7 5/8	7 15/16	8 3/16	8 7/16	8 11/16	8 7/8	
135	180	225	5 11/16	6 1/8	6 3/16	6 1/4	6 3/8	6 9/16	6 11/16	6 13/16	6 15/16	7 1/16	7 3/16	7 5/16	7 7/16	7 11/16	8	8 1/4	8 1/2	8 11/16	8 15/16	
150	200	250	5 7/8	6 1/4	6 5/16	6 7/8	6 1/2	6 5/8	6 13/16	6 15/16	7 1/16	7 3/16	7 1/4	7 3/8	7 1/2	7 3/4	8 1/16	8 5/16	8 9/16	8 3/4	8 15/16	
165	220	275	6 1/16	6 7/16	6 1/2	6 9/16	6 5/8	6 3/4	6 15/16	7	7 1/8	7 1/4	7 3/8	7 1/2	7 9/16	7 7/8	8 1/8	8 3/8	8 9/16	8 13/16	9	
180	240	300	6 1/4	6 9/16	6 5/8	6 11/16	6 3/4	6 7/8	7	7 1/8	7 1/4	7 5/16	7 7/16	7 9/16	7 11/16	7 15/16	8 3/16	8 7/16	8 5/8	8 7/8	9 1/16	
195	260	325	6 7/16	6 11/16	6 3/4	6 13/16	6 7/8	7	7 1/8	7 3/16	7 5/16	7 7/16	7 9/16	7 5/8	7 3/4	8	8 1/4	8 1/2	8 11/16	8 15/16	9 1/8	
210	280	350	6 9/16	6 13/16	6 7/8	6 15/16	7	7 1/8	7 3/16	7 5/16	7 7/16	7 1/2	7 5/8	7 3/4	7 13/16	8 1/16	8 3/16	8 9/16	8 3/4	8 15/16	9 3/16	
225	300	375	6 3/4	6 15/16	7	7 1/16	7 1/8	7 1/4	7 3/8	7 7/16	7 1/2	7 5/8	7 11/16	7 13/16	7 15/16	8 1/8	8 3/8	8 5/8	8 13/16	9	9 1/4	
262.5	350	437.5	7 1/16	7 1/4	7 5/16	7 3/8	7 7/16	7 1/2	7 9/16	7 5/8	7 3/4	7 13/16	7 15/16	8	8 1/8	8 5/16	8 1/2	8 11/16	8 7/8	9 1/8	9 3/8	
300	400	500	7 1/16	7 3/16	7 9/16	7 5/8	7 11/16	7 3/4	7 15/16	7 7/8	8	8 1/16	8 1/8	8 3/16	8 5/16	8 1/2	8 11/16	8 7/8	9 1/8	9 5/16	9 7/16	
337.5	450	562.5	7 11/16	7 13/16	7 7/8	7 7/8	7 15/16	8	8 1/16	8 1/8	8 3/16	8 1/4	8 5/16	8 7/16	8 1/2	8 11/16	8 7/8	9 1/16	9 1/4	9 7/16	9 5/8	
375	500	625	8	8 1/16	8 1/8	8 1/8	8 3/16	8 1/4	8 5/16	8 3/8	8 7/16	8 1/2	8 9/16	8 5/8	8 11/16	8 7/8	9	9 3/16	9 3/8	9 9/16	9 3/4	
412.5	550	687.5	8 1/4	8 5/16	8 3/8	8 3/8	8 7/16	8 7/16	8 1/2	8 9/16	8 5/8	8 11/16	8 3/4	8 13/16	8 7/8	9	9 3/16	9 3/8	9 1/2	9 11/16	9 7/8	
450	600	750	8 1/2	8 5/16	8 9/16	8 5/8	8 3/8	8 11/16	8 3/4	8 3/4	8 13/16	8 7/8	8 15/16	9	9 1/16	9 3/16	9 3/8	9 1/2	9 5/8	9 13/16	10	

Bending Moments in Thousands of Inch Pounds.

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